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The observations were for the most part taken before the close of daylight, at which time, the tail and coma not being visible, the nucleus was well defined and suitable for accurate determination of its position. Later in the evening I was frequently disturbed by visitors, but through the kind assistance of my friend Mr. J. T. Towson, the following measures of the nucleus, coma and tail were obtained at about 20^h, Liverpool sidereal time, each evening.

Date.	Diameter of Nucleus.	Diameter of First Envelope.	Diameter of Second Envelope.	Distance from Centre of Nucleus to Front of Coma.	Diameter of Coma at Right Angles to Tail Measured through Centre of Nucleus.	Length of Tail Measured along the Curve on the Convex Side.	Distance from Nucleus to End of Tail in a Straight Line.	Greatest Diameter of the Tail.
1858.	″	′ ″	′ ″	′ ″	′ ″	° ′	° ′	° ′
Sept. 30	17	2 1		1 26	5 46	26 35	26 0	3 10
Oct. 4	20	1 40		1 32	4 28	34 20	31 30	6 0
8	22	1 52	5 37	3 36	8 46	39 30	35 0	7 30
11	23	1 54	5 43	4 19	10 39	..	..	..

Decided dark spots were seen in the coma near the nucleus; one on the 8th and two on the 11th of October. The tail was curved towards the north, and broadest at or near the end. It was more luminous and better defined on the convex than on the concave side, and a dark band passed from the nucleus through the centre to the extreme end of the tail. On the 30th September a well-defined conical shadow was visible, the length of which, measured from the nucleus or the base of the cone to the apex, was 18′. The length of this shadow on the 4th October was 21′, but the contrast between it and the dark band in the centre of the tail was much less striking than it was on the 30th September. On the 8th October it was rendered invisible by the increased darkness of the band which passed through the centre of the tail. The tail of the comet was more symmetrical and the envelope was brighter and better defined on the 30th September than on any other occasion.

On the Advantages to be derived from the Use of Silver Mirrors for Reflecting Telescopes, and on a Novel Method of Mounting such Instruments. By Dr. Steinheil.

(*Translation of a Letter from Dr. C. A. Steinheil of Munich, to Professor C. A. F. Peters of Altona, published in No.* 1138 *of the Astronomische Nachrichten*).

"What mainly induces me to address this communication to you is a wish to make you acquainted with the result of my

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latest experiments,—a result that appears likely to lead to a total modification in the construction of astronomical instruments. Do not be alarmed at the sanguine hope expressed in the above proposition, but allow me to detail the observations on which it is founded.

"As long as two years ago (see the supplement to the *Augsburger Allgemeinen Zeitung* of the 24th March, 1856, first article) I constructed a telescope with silvered glass mirrors. The silvering was effected by Liebig's process, and the extremely thin coat of silver adhered so firmly to the glass that its metal-side could be polished with soft leather without injury. The mirror afforded a surprisingly good image, and I even at that time entertained the hope of arriving by this course at a durable construction of catoptrical instruments, inasmuch as the base of glass maintains the form of the mirror. Quite recently I have taken the matter up again, which in the meanwhile M. Léon Foucault, see the *Comptes Rendus*, vol. xliv., No. 7, Feb. 1857, p. 339, without being acquainted with my experiments, has laid before the Institute of France as something novel.

"Very recently Liebig has materially improved his method of silvering, so that one can now obtain faultless mirrors of any size that are coated so thinly with silver that the sun when looked at through the silvering appears like a sharply defined blue disk of light. These mirrors, too, bear polishing on the metal-side quite readily. One has simply to rub the surface with a little cotton pad covered with the finest glove-leather. In a few minutes a high polish is obtained, quite without scratches. I have determined the reflecting powers of these mirrors by carefully measuring their brightness with my eye-piece photometer; and at the same time I observed also therewith other mirrors as well as prisms, and likewise object-glasses, by way of comparison.

"The following amount of brightness was obtained for an angle of reflexion of 45°, that due to direct light being considered = 100:—

	Brilliancy.	Loss of light per cent.
Direct light	100·00	0·0
Silver mirror	91·00	8·9
Quicksilver mirror with glass	76·50	23·5
Metal mirror, Lord Rosse's alloy	67·18	32·8
Object-glass, by Fraunhofer, of 34 French lines aperture, and 42 inches focal length	76·00	24·0
One of my object-glasses of 21 French lines aperture and 21 inches focal length	86·67	13·3
Crown-glass prism of 50 French lines aperture	77·00	23·0

"It thence follows that silver mirrors reflect more light than rectangular glass prisms, and that after a second reflexion

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they still have more light than Fraunhofer's object-glasses, and, finally, that after three reflexions they yet have more light than the present mirrors of telescopes after a single reflexion. We are enabled, therefore, by the employment of silver mirrors to construct reflecting instruments that with equal aperture are *superior* to our achromatics in their amount of light.

"I have examined to what degree the accuracy of the form extends. For although the coat of silver is very thin there, nevertheless in giving the polish it might be more rubbed off at one part than another, and the form be thereby injured. My spherometer, which rests on mirrors of contact without axes, enables me to produce a glass surface of any radius of curvature upon which there is not anywhere a deviation from the sphere amounting to a hundred thousandth of a French line. I see indeed up to two millionths of a line, but I am only certain in my measurement up to about seven millionths. When an object-glass (one of about 6·5-inches aperture, English measure) is finished with this degree of precision, it unites the rays with sufficient accuracy. This cannot, however, be recognised in the image, but only on changing the position of the eye-piece towards the focal point of the object-glass. If, namely, the image of the sun upon a highly-polished steel ball about half-an-inch in diameter (the inclosed space being maintained at a uniform temperature) is observed, at the distance of about 60 feet, with a refractor of 4-inches aperture, using a power of about 250, it will have the appearance of a star of the first magnitude when the air is quite steady, and look like a small defined disk of light encircled by fine coloured rings (Schwerd has explained the theory of this in his 'Beugungserscheinungen,' or 'Phenomena of Inflexion'). But on drawing out the eye-piece about half-an-inch, there is formed a disk of light consisting of concentric spectrum-rings. These are due to the interference of the rays proceeding from one point, and each ring corresponds to a determinate zone of the object-glass wherein the rays interfere by one length of wave. These rings, therefore, are the best test of the accuracy of the form, since they at the same time indicate whether the individual portions of a line of wave are situated symmetrically. I have tested my silver mirror by this means; it showed the interference-rings precisely as a good object-glass does. Upon this the mirror was again submitted to another polishing, and that without any further precaution. No alteration of any kind in the effect on the rings was however observable.

"Whether a plane mirror is worked sufficiently true is best seen at small angles of reflexion. If a star at an angle of reflexion of 5° still appears round and sharp, and if the interference-rings remain rigorously circular the mirror acts satisfactorily. This test is even more sensitive than altering the position of the eye-piece with a direct and a reflected image. I possess silver mirrors that stand these tests perfectly well.

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"Now, I infer from the above, firstly, that the forms of silver mirrors can be produced with sufficient accuracy *to afford the same precision of the image* that is attained with refractors, and I thereby refute practically the opinion that reflectors never give as distinct images as refractors do, and, secondly, that a subsequent polishing of the mirror, which may become necessary, should it tarnish with time, has no appreciable influence on the form of the mirror. When one considers that these mirrors may be protected from tarnishing when they are not in use by a cover of india-rubber, so that a fresh polish will not have to be given to them above once a-year—object-glasses, too, must be cleaned at least once during that time—and that if after the lapse of many years the silver surface of the mirror should have suffered, it is a light matter to have it silvered again, the objection hitherto brought against catoptrical instruments on the score of their want of durability appears also to be overcome.

"Hence we now possess reflectors which are in every respect free from the faults of the former instruments. What advantages in the mechanical construction of astronomical instruments may not be attained if one may presuppose two reflexions! I will here only touch shortly upon two arrangements, treating this matter in detail in a monography, that the Bavarian Academy of Sciences will publish in the ensuing autumn on the occasion of its centenary anniversary.

"*Catoptrical meridian circle, or transit.* The axis of the concave mirror of 6-inches aperture and 36-inches focal length, lies east and west, the mirror is fixed on a stone pillar. It receives light from a plane mirror, permanently fixed at an angle of 45°, and which rotates round the prolongation of the optical axis of the concave mirror. This axis of rotation, as also the plane mirror, is traversed by an aperture, so that the image of a point in the meridian falls in the axis of rotation. The cross wires are placed here, and the eye-piece sees them distinctly, as well also as the image of the point in the meridian. An altitude circle fixed firmly on the perforated axis, and lying in the plane of the meridian, measures the nadir distances from a quicksilver horizon. The spherical aberration of the marginal rays of this mirror amounts to 0″·374, and this is strictly corrected by means of a small object-glass, having a long negative focus, which is inserted in the tube 3 inches in front of the cross wires. If both the mirrors are attached to the same stand, pretty much in the manner shown in the figure, we have a reflecting telescope mounted horizontally, since a rotation about A alters the azimuth, while a rotation about B alters the altitude.

"If the axis A be made to coincide with the axis of rotation of the heavens, the telescope is equatoreally mounted, for rotation about A measures the hour-angle, about B the declination. Of course the eye-piece tube is provided with a finder,

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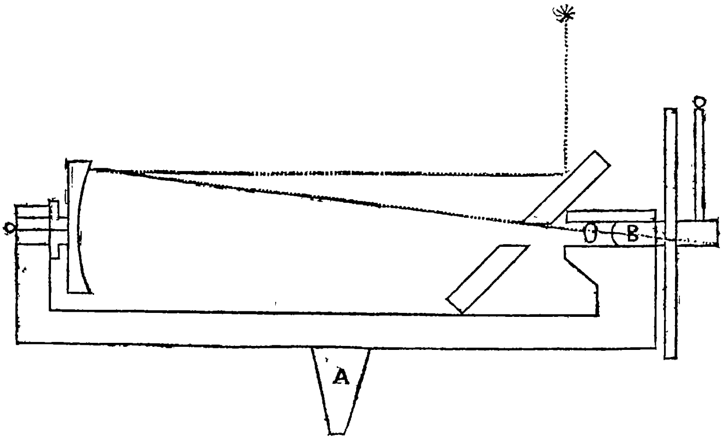
for the sake of more readily meeting with the objects. This telescope possesses, moreover, another advantageous quality, the cost of an instrument of 6·4 inches aperture English measure



is only 300 Bavarian florins (about 25*l.* 10*s.*), and in its action it must be superior to a refractor of equal aperture, because it is free from chromatic aberration. For this reason, especially, catoptrical heliometers will possess peculiar recommendations. I am convinced that by the employment of silver mirrors upon glass we shall arrive at obtaining reflecting telescopes of colossal dimensions. Only in that case it will be necessary to adopt a method of mounting them different to that now in use. It appears to be indispensable to give the telescope, or rather the two mirrors respectively, for the tube may be dispensed with, a constant position.

"If the axis of the concave mirror is brought to coincide with that of the rotation of the heavens, and if the plane mirror, the centre of which is perforated, is so disposed that it transmits to the concave mirror situated parallel to its axis, the parallel rays proceeding from a star, then can the image, formed by the concave mirror be observed through the aperture in the plane mirror, and the elimination of the diurnal rotation of the earth is reduced simply to a rotation of the plane mirror about the axis of the heavens. For other declinations one has only to give the plane mirror another inclination. When thus arranged no special observatory is needed for the erection of a telescope of 2-feet aperture. The plane mirror might be adapted in front of a window of a dwelling-house, the concave mirror being situated below on the ground in the direction of the axis of rotation of the heavens. A tube between the two mirrors would be quite superfluous.

"By means of this application instruments of great optical power, and simple and convenient to manage, are rendered accessible to the admirers of astronomy, and that, too, at a moderate outlay, which is a point that should not be by any means overlooked.

"*Munich, April* 5, 1858."